Current Projects - Lakes, Ponds and Reservoirs

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Evaluating the Effects of Low-dose Rotenone Toxicity on Fish, Benthic Invertebrates, Freshwater Mussels and Zooplankton

The use of rotenone to restore aquatic ecosystems is often necessary when undesirable fish species negatively affect physiochemical conditions (e.g., bioturbation, nutrients) and other fish species. Gizzard shad is an omnivorous fish species native to the midwestern and southern US that can attain high biomass and often predominate fish assemblages. At high abundance, gizzard shad can negatively impact sport fisheries and are commonly targeted for removal or control at low abundances. Biomanipulation using piscicides (e.g., rotenone) is costly, time consuming, and often used only after fish assemblages have been substantially altered (e.g., few sport fish and abundant benthic omnivores). Traditionally, in Iowa, rotenone has been applied at rates that eradicate the existing fish communities, requiring restocking efforts and having short-term negative effects on local economies. However, the increased susceptibility of gizzard shad to low oxygen levels makes them potentially vulnerable to low-dose rotenone treatments as a control without substantially impacting other fish species. The overall objective of this study was to determine the effects of varying low-dose rotenone concentrations on various fish species (i.e., gizzard shad, bluegill , largemouth bass, walleye), benthic macroinvertebrates, freshwater mussels, and zooplankton.

Rotenone concentration effects were evaluated through use of mesocosm experiments in fall 2011. Experimental treatments included five targeted rotenone concentrations (i.e., 0, 3, 6, 9, and 12 [g/L). Each mesocosm was stocked with 30 individuals of gizzard shad, bluegill, largemouth bass, and walleye. Water samples were taken at 1, 24, 72, and 120 hours post application to monitor rotenone concentrations and decay through time. In addition to fish, benthic macroinvertebrates and zooplankton were sampled before and after the completion of the experiment. A common lentic freshwater mussel species (i.e., giant floater) was stocked into mesocosms, with survival determined after completion of the experiment. Walleye were more susceptible than gizzard shad, while bluegill and largemouth bass were more tolerant. Overall, results from this study will provide knowledge on the relative influence of rotenone concentrations on gizzard shad, bluegill, largemouth bass, and walleye that can be used by managers to better target and more efficiently use resources for improving ecological integrity in Iowa lakes.

In conjunction with this mesocosm study, during 2011 and 2012, field trials were conducted on seven Iowa lakes that were illegally stocked with gizzard shad. Low-dose rotenone treatments were applied to eliminate gizzard shad, yet maintain the sport fishery in Don Williams Lake in Boone County, Badger Creek Lake in Madison County, Lacey Keosauqua Lake in Van Buren County, Humeston Reservoir in Wayne County, Lake Fisher in Davis County, Hannen Lake in Benton County, and Binder Lake in Adams County. During 2011, walleye, musky, and grass carp were held within cages in five of these lakes to determine the effect of the low-dose rotenone treatments on these species. With detailed lake maps, rotenone was applied at a target concentration of 6.0 µg/L or 9.5 µg/L. Water samples were collected on each lake at 1, 5, 10, and 20 days post-application to determine actual rotenone concentration after application and to estimate the rate that rotenone dissipates from each system. Results suggest target rotenone concentrations should be 9—11 µg/L to control gizzard shad. A reduction in bluegill abundance was common, yet acceptable due to the poor size structure and growth rates experienced prior to renovation; walleye were very susceptible to eradication at these rotenone concentrations. These methods may also be useful for eradicating yellow bass, which is another nuisance species that has been introduced into multiple southern Iowa impoundments.